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ABSTRACT

Attitudes toward school and three personality characteristics (introversion, impulsivity, and emotional stability) were measured in Swedish students from 60 sixth grade classes. The School and We Questionnaire (SAW) and a Swedish translation of the High School Personality Questionnaire were completed by 1,319 students. Secondary data analysis was conducted at two levels of aggregation: pupils within classes, and differences between classes. The same factors were found at both levels: (1) attitude toward school and schoolwork; (2) attitude toward teacher; (3) relations with classmates; (4) social relations in the entire class; and (5) class behavior or discipline. At the two levels of data analysis, these factors accounted for different amounts of variance. At the class level, factors reflecting attitudes toward teacher and characteristics of the entire class were strong; while at the individual level, factors reflecting school attitudes and the individual's relations with classmates were strong. Impulsivity accounted for the most variance in SAW scores. Within a class, impulsivity was negatively correlated with attitudes toward school and teacher. Between-class analysis indicated a high negative correlation between impulsivity and class discipline. Introversion was negatively correlated with peer relations, while stability was positively correlated. (Author/GDC)

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ABSTRACT

The responses of the pupils in 60 6th grade classes to a 40-item questionnaire assessing attitudes towards the school, the teacher and the classmates is factor analyzed at two levels of aggregation, classes and pupils-within-classes. The same factors were found at both levels but they accounted for different amounts of variance: At the class level factors reflecting attitudes towards the teacher and characteristics of the class as a whole were strong, while at the individual level factors reflecting attitudes towards the school and the individual pupil's relations to the classmates were strong. Relations between personality variables and the attitude scales are also studied at the two levels of aggregation and implications of the results for the measurement of personality are discussed.

INTRODUCTION

With few exceptions, statistical analyses of educational research studies are based on the individual pupils´scores. However, most educational processes do take place with the pupils organized into classes; thus the pupils are not independent units of observation but they do have a more or less common history of experience. It has been argued (e.g. Peckham, Glass & Hopkins, 1969) that when classes are sampled, class means should be analyzed instead of pupils´scores. However, Cronbach (1976) claimed that neither analyses at the individual level, nor analyses at the class level yield a sufficiently complete picture; instead the hierarchical nature of the observations should be clarified and the individual scores decomposed into components for different levels of aggregation, to obtain separate estimates for different levels. It was shown, both theoretically and in empirical examples, that patterns of results from regression analysis, covariance analysis, and multivariate analysis etc. may be drastically different at different levels of aggregation.

The present paper presents within-class and between-class factor analyses of a questionnaire designed for assessing attitudes towards the school, the teacher and the classmates. Some or all of these aspects can be suspected to be sensitive to variation between classes; an ordinary factor analysis based on the individual pupils´scores is therefore likely to fail to reflect the true dimensionality of the responses.

The paper has both a methodological and a substantive purpose and to add to both of these, relations between the dimensions established in the factor analysis and personality variables will be studied.

METHOD

Instruments

The attitude questionnaire was originally constructed by Johannesson (1960), under the name Our class; here, however, a somewhat shortened version developed within the DPA-project (Didactical Process Analysis, Bredänge et al.,1971), has been used. The questionnaire will be referred to as the SAW questionnaire (The School and We, as would be the literal English translation of the Swedish name).

The SAW contains 40 questions or assertions, each of which is to be answered through circling one of the 5 alternatives ALWAYS, OFTEN, SOMETIMES, SELDOM and NEVER. There are both positive and negative assertions, but the responses were coded in such a way that a higher code throughout represents a more positive attitude.

When the SAW was constructed the questions were classified inte three groups to yield scores on three different scales: one assessing attitude towards the school (18 items, 7 positive and 11 negative); one measuring attitude towards the teacher (9 items, all positive); and one measuring attitude towards the classmates (13 items, 6 positive and 7 negative). The grouping was validated on the basis of measures of internal consistency, but the dimensionality of the questionnaire has never been investigated with factor analysis.

Pupil personality was measured with a translation into Swedish of the High School Personality Questionnaire (HSPQ, Cattell, Coan & Beloff, 1957). However, the 13 dimensions purportedly measured by the HSPQ could not be refound in factor analyses of the version used; therefore the items were reorgnized into three scales.

The scales could be interpreted as measuring Introversion, Impulsivity and Emotional stability. The Introversion scale consists of 12 items, most of which measure the sociability aspect of introversion. The impulsivity scale contains 16 items, most of which reflect adventerousness and weak superego control. The Stability scale consists of 18 items asking about the tendency not to get emotionally upset and nervous.

Subjects

The data analyzed here were originally collected within the DPA-project (Bredänge et al., 1971), and are here only used for secondary analyses.

The DPA-project comprised 60 classes in grade 6, with in all 1601 pupils. It was, however, impossible to obtain complete data from all the pupils. The SAW questionnaire was answered by 1435 pupils, which is the number of pupils on which the factor analyses are based. Class sizes varied between 17 and 30.

The analysis of the relationship between the HSPQ scales and the SAW will, however, be based on a somewhat lower number of pupils; 1319 pupils answered both these questionnaires. The reason for this additional attrition of the group is that the questionnaires were administered at two different occasions.

Statistical analysis

The data will be analyzed at two levels of aggregation, pupils-within-classes and between classes. A third level, school, could in principle be recognized in the data, but since only few schools were represented with more than one class, analyses taking into account this third level would not be informative.

Cronbach (1976) recommend that in two-level analyses, each pupils' score is transformed inte two components: the class mean and the deviation of the raw score from the class mean. Covariance matrices are then computed, using the class means for the between-class covariance matrix, and the deviation scores for the within-class matrix; in both cases, however, with the total number of pupils as the number of observations. This means that the estimates are weighted in relation to the number of pupils, and the ordinary pooled covariance matrix is obtained as the sum of the between-class and within-class covariance matrices.

An estimate of the intraclass correlation for a variable can be obtained through forming the variance ratio for the between-class variance and the total variance. This estimate is biased, since it does take into account the variance between classes resulting from random assignment of pupils to classes (Härnqvist, 1978). However, Cronbach (1976) argued that pupils within classes must be considered as fixed; each class has a unique history and therefore it is not reasonable to speculate about the possible results of another particular assignment of pupils.

The factor analyses will be based on scale-free covariance matrices, in which each element in the covariance matrices for the within- and between-class levels is divided with the product of the standard deviations, at the pooled level, for the pair of variables involved. The diagonal contains for the between-class level the intraclass correlations and for the within-class level, 1 minus the intraclass correlation. These two matrices sum to the ordinary correlation matrix for the pooled data. (cf. Cronbach, 1976; Härnqvist, 1978). Thus the total variance factor analyzed at the between-class level is the sum of the intraclass correlations, and the remainder of the variance is analyzed at the within-class level.

The EFAP program of Jöreskog and Sörbom (1976), was used to compute maximum likelihood solutions, at the

within-class and between class levels, under different assumptions as to the number of factors, and these solutions were followed by Varimax rotations. The maximum likelihood approach allows a statistical test of the hypothesis that a certain number of common factors is sufficient to account for the structure of correlations. Considering, among other things, the problems in determining the actual degrees of freedom, however, little importance was attached to these statistical tests.

RESULTS

Results will be presented from 5-factor solutions, since the factors in those solutions seemed to reflect dimensions of interest from a substantive point of view. Table 1 presents the items with high loadings in the 5 factors in

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Insert Table 1 about here

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the between-class and within-class analyses, along with the intraclass correlations. Rather surprisingly, the same items tended to load highly at both levels. In the few cases where an item loaded highly in the analysis at one level only it has been included in Table 1 anyway.

Factor 1 is loaded highly by items measuring attitude towards the school and schoolwork and it will be called the School factor. The loadings in the within-class analysis generally are 2 to 3 times as large as those in the between-class analysis, but the factor is clearly established at both levels.

Factor 2 is defined by items measuring attitudes to, and perceptions of, the teacher, and it will be called the Teacher factor. The loadings in the between-class analysis tend to almost as large as those in the within-class analysis, and there are very sizeable intraclass correlations for most of the items with a high loading in this factor. Each class had a different teacher so a large

between-class variance is to be expected, but it is also interesting to note that there are systematic individual differences within the classes in the perception of the teacher.

Factor 3 is loaded highly by a group of items asking about the individual pupil's relations to classmates, and it will be labelled Relations to classmates. The loadings at the within-class level are 3 to 4 times as large as those at the between-class level, and the items loading this factor have the lowest intraclass correlations.

Also factor 4 is defined by items asking about social relations; in contrast with factor 3, however, these items refer to social relations within the class as a whole. The factor will be referred to as the Class relations factor. The loadings at the within-class level are two times, or less, as large as the loadings at the between-class level, and the intraclass correlations are of an intermediate size.

Factor 5, finally, is loaded highly by items referring to the behaviour or discipline of the class, and the factor will be called the Class discipline factor. Both the intraclass correlations and the loadings in the between-class analysis vary greatly for the items loading this factor, but for some items they are sizeable.

The factor analysis thus shows that the items originally classified as measuring attitudes towards the school and the teacher each form a separate factor. However, the items constructed to measure attitudes towards classmates in fact form 3 factors: One reflecting the individual pupil's relations to classmates; one reflecting social relations within the class; and one reflecting the discipline of the class.

These 5 factors could be identified at both levels, even though the relative size of the loadings at the within-class level and the between-class level is different for

the factors. This appears in greater detail from Table 2 where the amount of variance explained by the factors at the two levels is shown.

Insert Table 2 about here

In the between-class analysis the Teacher factor accounts for most variance, then follows the School factor, the Class discipline factor, the Class relations factor and the Relations to classmates factor. In the within-class analysis the School factor is the one accounting for most variance, followed by the Teacher factor, the Relations to classmates factor, the Class relations factor and the Class discipline factor. Thus even though it is possible to find the same factors at both levels of the hierarchical analysis, it is obvious that different sources of variance influence the factors differently.

To study correlations, at the within-class level and the between-class level, between the personality variables and the attitude factors, 5 scales were constructed through assigning each item in the SAW questionnaire to the factor it loaded highest. Statistical characteristics of the scales are presented in Table 3. As can be expected the

Insert Table 3 about here

intraclass correlations vary greatly between the scales, with the Teacher scale having the largest intraclass correlation and the Relations to classmates scale having the lowest intraclass correlation. The personality variables, characteristics of which have also been entered in Table 3, tend to have the lowest intraclass correlations; as is evident from the F-ratios from one-way analyses of variance with class as the factor they are significant, however, for both Introversion and Impulsivity.

Table 4 presents correlations between the SAW scales and the personality variables at the two levels. The correlations have been computed from between-class and within-class covariance matrices which were standardized to have unities in the diagonal.

Insert Table 4 about here

Impulsivity is the personality variable which accounts for most variance in the SAW scales. In the within-class analysis there are rather strong negative correlations with the School and Teacher attitude scales; this does not to the same extent hold true at the class level, so had pooled correlations been computed instead, weaker correlations would have been found with Impulsivity. In the between-class analysis there is a rather high negative correlation between Impulsivity and the Class discipline scale.

The other personality variables yield few correlations worth mentioning. It can be observed, however, that Introversion both at the class level and at the individual level is negatively correlated with the Relations to classmates scale and that there, at the class level, is a negative correlation between Introversion and the Social Relations scale. Stability is positively correlated with Relations to classmates, both in the between-class analysis and in the within-class analysis.

DISCUSSION AND CONCLUSIONS

The factor analyses at the two levels of aggregation resulted in the same factors at both levels, in spite of the fact that no constraints, other than those dictated by the number of factors and the Varimax criterion, were imposed. An empirical example that the same factors are not necessarily found at both levels in this kind of analysis is given by Härnqvist (1978).

But it was found that the two levels contribute differently to the factor variance: There are factors mainly influenced by differences between pupils within classes such as the Relations to classmates factors and the School factor, but there are also factors heavily influenced by differences between classes, such as the Teacher factor and the Class discipline factor. In an ordinary factor analysis, disregarding the hierarchical nature of the observations, it would necessarily have been assumed that only differences between pupils are reflected in the factor variance.

It appears that the most interesting pattern of correlations with the personality variables is found at the class level: Impulsivity is correlated with Class discipline, and Introversion with Social relations and Relations to classmates. It is quite interesting that personality variables, which are usually taken as purely individual measures, do show interpretable correlations also at a higher level of aggregation.

Two interpretations can be suggested to account for this. In the first place it is clear that even if assignment to classes is random there will be differences between the classes with respect to personality and it is possible that even slight differences in the compositon of the classes can have important effects on the flow of events in the class. But, secondly, it must also be pointed out that both questionnaires were answered while the pupils attended the same class; therefor the measurement of personality is not independent of class. For example, if a teacher places only little weight on the social relations within the class, this is also likely to result in a higher mean of the class on the introversion scale.

Since in this case both questionnaires were answered while the pupils attended the same class it is not possible to decide which of these interpretations of the correlations at the class level is the correct one. However, since there were significant intraclass correlations also for the personality variables it does seem that

there may be an effect of class belongingness on the measurement of personality.

The 130 items in the HSPQ have been analyzed for class effects. There were only few significant intraclass correlations, but for a group of items with specific reference to the school and the class, significant intraclass correlations were found. The conclusion that such items with a specific situational reference are sensitive to class effects does have implications for the measurement of personality.

Bennett and Youngman (1973,cf. Bennet, 1973) criticized the Junior Eysenck Personality Inventory for asking questions framed in too general terms and they claimed that "In the school setting it seems likely that institutional demands are sufficiently strong to swamp the effects of individual differences in personality. In such a situation a general inventory like the JEPI is of limited utility and validity... It would, therefore, seem more useful to design inventories which have a clear meaning in the particular situations encountered" (Bennett & Youngman, 1973, p. 233). The rationale behind this suggestion is sound enough, but if proper account is not taken of the class effects which are likely to result from such an approach this may create more severe problems in educational research than those caused by attempts to measure personality without clear reference to context. Since classes are different, references to specific situations will have different meaning for the pupils in different classes, and such differences will enter systematically into the responses. If such data are analyzed as individual data there is a great risk that spurious relationships will be found between the personality variables and other variables, such as achievement and attitude variables.

To guard against such spurious relationships, and also to study relationships at the class level in their own right, the methodology exemplified in this paper does seem well suited.

Table 1

The items in the SAW questionnaire with high loadings in the two-level factor-analyses. Factor loadings shown are varimax-rotated loadings from maximum likelihood solutions.

Item	Loading		Intraclass correlation
	Within classes	Between classes	
Factor 1			
5. It is fun to go to school	.73	.27	.11
9. It is boring to go to school	.73	.29	.11
25. I find the lessons boring	.67	.29	.13
22. Work at school is dull and monotonous	.67	.29	.12
18. I think that the lessons at school pass away slowly	.58	.25	.10
6. I think that the work on the lessons is fun.	.61	.21	.09
29. I want to leave school earlier in the day	.53	.21	.09
30. I think that the lessons at school pass away fastly	.50	.20	.07
4. In the mornings I want to stay home from school	.50	.18	.08
15. In our class the lessons are fun and interesting	.48	.19	.15
21. It would be more fun if we were allowed to do what we want at the lessons	.52	.23	.11
11. It would be better to have a job than go to school	.47	.18	.09
37. Work at school is nice and shows variation	.55	.19	.12
Factor 2			
33. Our teacher is nice and kind	.56	.53	.36
17. Our teacher is calm and in good temper	.54	.48	.30
35. Our teacher keeps his/her promises	.51	.41	.27

Table 1 continued

Item	Loading		Intraclass correlation
	Within classes	Between classes	
38. Our teacher treats all pupils alike	.47	.37	.23
10. Our teacher listens to our questions	.48	.32	.19
13. Our teacher helps us much	.47	.31	.15
Factor 3			
23. My classmates scold me	.64	.22	.07
19. I get enemies among my classmates during the breaks	.55	.13	.07
24. I feel forlorn at school	.54	.13	.06
20. All my classmates are kind to me	.52	.11	.07
Factor 4			
26. In our class all the pupils are good friends	.58	.28	.11
27. In our class the pupils help each other	.49	.29	.14
20. All my classmates are kind to me	.38	.17	.07
39. In our class we are together during the breaks	.34	.25	.13
32. In our class the pupils contend with each other	.28	.23	.12
Factor 5			
16. In our class we neglect school work	.43	.22	.13
7. During the lessons we are calm and quiet	.27	.36	.26
14. Druing the breaks the pupils in our class fight	.43	.13	.13
32. In our class the pupils contend with each other	.37	.19	.12
40. In our class we do exactly as the teacher says	.23	.24	.18

Table 2 Contributions of variance by the factors in the within- and between-class analyses.

	Within classes		Between classes	
Factor	Amount	per cent[1)]	Amount	per cent[1)]
School	5.31	15	1.06	20
Teacher	2.75	8	1.77	33
Relations to classmates	1.73	5	.18	3
Class relations	1.32	4	.44	8
Class discipline	.94	3	.43	8
Total	12.05	35	3.88	72

1) The percentages have been computed from the total amounts of variance analyzed, 34.6 and 5.4 for the within- and between-class analyses, respectively.

Table 3 Characteristics of the scales measuring attitude and personality.

Scale	No of items	Intraclass correlation	F-ratio[1)]
Attitude variables			
School	15	.16	4.24
Teacher	12	.32	11.21
Relations to class-mates	6	.08	1.91
Class relations	3	.17	3.85
Class discipline	4	.22	6.93
Personality variables			
Introversion	14	.06	1.42
Impulsivity	16	.07	1.51
Stability	18	.05	1.25

1) The F-ratios are computed in oneway analyses of variance with class as factor, critical value $F_{.95}(59, \infty) = 1.39$.

Table 4 Correlations between the personality variables and the attitude variables at within- and between-class levels.

	Introversion		Impulsivity		Stability	
	Within	Between	Within	Between	Within	Between
School	-.04	.06	-.38	-.16	-.01	-.05
Teacher	.03	.06	-.32	-.04	.01	-.03
Relations to classmates	-.27	-.29	-.10	-.23	.28	.28
Class relations	-.15	-.28	-.11	-.22	.09	-.10
Class discipline	.02	.07	-.21	-.34	.10	-.16

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